

**Amendments to the Claims:**

This listing of claims will replace all prior versions, and listings, of claims in the application:

**Listing of Claims:**

1. (Canceled)

2. (Currently amended): A digital telemetry system having improved data rate and robustness, comprising:

a data transmission cable having a first end and a second end, and capable of transmitting data on at least two propagation modes;

a data source connected at the first end and having data transmission circuitry to generate data signals on the at least two propagation modes;

a receiver connected to the second end whereon the receiver receives signals on a first and second of at least two propagation modes and having

a processor connected to a storage medium storing instructions directing the processor to execute

an adaptive far-end cross-talk cancellation logic for canceling cross-talk that occurs between the first and second propagation modes, -wherein the adaptive far-end cross-talk cancellation logic comprises

a first propagation mode cross-talk adjustment logic to direct the processor to receive samples on ~~a~~ the first propagation mode and having a second propagation mode cross-talk adjustment logic to direct the processor to accept samples from ~~a~~ the second propagation mode wherein the first propagation mode cross-talk adjustment logic directs the processor to adjust

the samples on the first propagation mode by values that are a function of the samples of the second propagation mode; and  
further comprises instructions to cause the processor to  
determine a slice residual from the output of ~~the~~ each of the first and second mode cross-talk adjustment logics; and  
update a cross-talk parameter from the slice residual.

3. (Canceled)

<sup>1</sup>  
2. ~~4.~~ (Currently amended): The digital telemetry system of Claim ~~2~~, wherein the adaptive far-end ~~adaptive~~ cross-talk cancellation logic causes the processor to accept as input one value on each of a plurality of carriers and to compute the cross-talk component for each carrier.

<sup>2</sup>  
3. ~~5.~~ (Currently amended): The digital telemetry system of Claim ~~4~~, wherein the adaptive far-end ~~adaptive~~ cross-talk cancellation logic directs the processor to compute the cross-talk component for each carrier by multiplying the signal received on the second propagation mode by a carrier specific coefficient.

<sup>3</sup>  
4. ~~6.~~ (Currently amended): The digital telemetry system of Claim ~~5~~, further comprising ~~wherein~~ a far-end cross-talk parameter update logic ~~directs~~ directing the processor to update each carrier specific coefficient as a function of the slice residual on such carrier.

7. (Currently amended): A digital telemetry system having improved data rate and robustness, comprising:

a data transmission cable having a first end and a second end, and capable of transmitting data on at least two propagation modes;

a data source connected at the first end and having data transmission circuitry to generate data signals on the at least two propagation modes;

a receiver connected to the second end whereon the receiver receives signals on a first and second of at least two propagation modes and having

a processor connected to a storage medium storing instructions directing the processor to execute

an adaptive far-end cross-talk cancellation logic for canceling cross-talk that occurs between the first and second propagation modes,

wherein the adaptive far-end cross-talk cancellation logic comprises a first propagation mode cross-talk adjustment logic to direct the processor to receive samples on a first frequency domain equalizer on the first propagation mode and having a second propagation mode cross-talk adjustment logic to direct the processor to accept samples to a second frequency domain equalizer from a the second propagation mode wherein the first propagation mode cross-talk adjustment logic directs the processor to adjust the samples on the first propagation mode by values that are a function of the samples of the second propagation mode, and

~~further~~ wherein the far-end adaptive cross-talk cancellation logic causes the processor to accept as input one value on each of a plurality of carriers to a far-end cross-talk determination circuit and to compute the cross-talk component for each carrier by multiplying the signal received on the second propagation mode by a carrier specific coefficient for the far-end cross-talk determination circuit and to update each carrier specific coefficient by applying the equation following:

$$CXY_i = CXY_i +$$

$$Alpha_{FEXT} * (< CEX_i, CEX_i > / REF\_MAGN^2) * < TXFFT\_out[i], TY_{residual}[i] >$$

where

CEXi is the frequency domain equalizer coefficient of the first frequency domain equalizer for the ith carrier of propagation mode X;

CXYi is the carrier specific coefficient for the far-end determination circuit for ~~cross-talk cancellation coefficient for the ith carrier~~ for cancelling far-end cross-talk from the first propagation mode X to the second propagation mode Y;

AlphaFEXT is a constant for balancing the tracking speed of CXYi against the stability of the value of CXYi;

REF\_MAGN is the Root Means Square (RMS) magnitude of CEXi;

TXFFT\_out[i] is the frequency domain data point of the received sample on the ith carrier on propagation mode X;

TYresidual[i] is the slice residual for the ith data point on the Y propagation mode; and

$\langle \rangle$  is a complex scalar product defined as  $\langle a+jb, c+jd \rangle = (a-jb) * (c+jd) = (ac+bd) + j(ad-bc)$ .

5 8. (Currently amended): The digital telemetry system of Claim <sup>1</sup>2, wherein the ~~far-end~~ first propagation mode cross-talk adjustment logic directs the processor to receive  $m$  samples from the second propagation mode and convolve ~~these~~ the  $m$  samples using  $m$  coefficients.

6 9. (Currently amended): The digital telemetry system of Claim <sup>5</sup>8, wherein the storage medium further stores instructions comprising ~~the~~ a slice determination logic and a coefficient update logic directing the processor to adjust the  $m$  coefficients as a function of ~~a~~ the slice residual determined by the slice determination logic.

8 10. (Currently amended): A digital telemetry system having improved data rate and robustness, comprising:

a data transmission cable having a first end and a second end, and capable of transmitting data on at least two propagation modes;

a data source connected at the first end and having data transmission circuitry to generate data signals on the at least two propagation modes;

a receiver connected to the second end whereon the receiver receives signals on a first and second of at least two propagation modes and having

a processor connected to a storage medium storing instructions directing the processor to execute

an adaptive far-end cross-talk cancellation logic for canceling cross-talk that occurs between the first and second propagation modes, the adaptive far-end cross-talk cancellation logic comprising a first propagation mode cross-talk adjustment logic to direct the processor to receive samples to a first linear adaptive equalizer on a first propagation mode and having a second propagation mode cross-talk adjustment logic to direct the processor to accept samples to a second linear adaptive equalizer from ~~a~~ the second propagation mode wherein the first propagation mode cross-talk adjustment logic directs the processor to adjust the samples on the first propagation mode by values that are a function of the samples of the second propagation mode,

wherein the ~~far-end~~ first propagation mode cross-talk adjustment logic directs the processor to receive  $m$  samples to a linear adaptive cross-talk determination logic from the second propagation mode and convolve ~~these~~ the  $m$  samples using  $m$  coefficients and the storage medium further stores instructions comprising a slice determination logic and a coefficient update logic directing the processor to adjust the  $m$  coefficients as a function of a slice residual determined by the slice determination logic using the ~~equation~~ following:

$$CXY_i = CXY_i + \text{AlphaFEXT} * (< CEX_i, CEX_i > / \text{REF\_MAGN}^2) * < TY_{(n-i)}, TX_{\text{residual}} > \quad \text{where,}$$

$CEX_i$  is the  $i$ th time domain equalizer coefficient of the first linear adaptive equalizer of the first propagation mode X;

$CXY_i$  is ~~the an  $i$ th coefficient~~ cross-talk cancellation coefficient for canceling far-end cross-talk of the linear adaptive cross-talk determination logic from the first propagation mode X onto the second propagation mode Y;

$TY_{(n-i)}$  is the  $(n-i)$ th sample from the second propagation mode Y;

$TX_{\text{residual}}$  is  $TX_{\text{Corr}} - TX_{\text{IdealPoint}}$

where  $TX_{\text{Corr}}$  is the cross-talk corrected output from ~~the cross-talk adjustment logic~~ a summer and  $TX_{\text{IdealPoint}}$  is an ideal constellation point for the first propagation mode X; and

$\text{AlphaFEXT}$  is a constant between 0 and 1;

$\text{REF\_MAGN}$  is the Root Means Square (RMS) magnitude of  $CEX_i$ ;

and

$< >$  is a complex scalar product defined as  $< a+jb, c+jd > = (a-jb) * (c+jd) = (ac+bd) + j(ad-bc)$ .

9 N. (Currently amended): The digital telemetry system of Claim <sup>8</sup> 10, wherein  $\text{AlphaFEXT}$  is in the range from 0.00001 to 0.001.

12. (Canceled)

13. (Canceled)

14. (Canceled)

10 15. (Currently amended) A method of digital telemetry having improved data rate and robustness by canceling far-end cross-talk from a near-lying propagation mode, comprising:

inputting a first sample received on a first propagation mode to a first frequency domain equalizer;

inputting a second sample received on a second propagation mode to a second frequency domain equalizer;

determining a slice residual;

determining a cross-talk component from the second sample on the first sample ;

adjusting a function used to determine the cross-talk component of a far-end cross-talk determination circuit as a function of the slice residual; and

determining an output by subtracting the cross-talk component from the second sample from the first sample, wherein the cross-talk component is determined by multiplying a carrier specific coefficient with a sample received on a corresponding carrier on the near-lying propagation mode and the coefficients is updated by applying the ~~function~~ following:

$$CXY_i = CXY_i +$$

$$\text{AlphaFEXT} * (< CEX_i, CEX_i > / \text{REF\_MAGN}^2) * < \text{TXFFT\_out}[i], \text{TYresidual}[i] >$$

where

$CEX_i$  is the frequency domain equalizer carrier for the  $i$ th carrier of the first propagation mode X;

$CXY_i$  is the carrier specific coefficient for the far-end cross-talk determination circuit ~~cross-talk cancellation coefficient for the  $i$ th carrier~~ for canceling far-end cross-talk from the first propagation mode X to the second propagation mode Y;

AlphaFEXT is a constant for balancing the tracking speed of  $CXY_i$  against the stability of the value of  $CXY_i$ ;

REF\_MAGN is the Root Means Square (RMS) magnitude of ~~magnitude of~~ CEXi;

TXFFT\_out[i] is the frequency domain data point on the ith carrier of the first propagation mode X;

TYresidual[i] is the slice residual for the ith data point on the second ~~Y~~ propagation mode Y; and

$\langle \rangle$  is a complex scalar product defined as  $\langle a+jb, c+jd \rangle = (a-jb) * (c+jd) = (ac+bd) + j(ad-bc)$ .

16. (Canceled)

17. (Canceled)

18. (Canceled)

// 19. (Currently amended) A method of digital telemetry having improved data rate or robustness by canceling far-end cross-talk from a near-lying propagation mode, comprising:

inputting a first set of samples received on a first propagation mode to a first linear adaptive equalizer;

inputting a second set of samples received on a second propagation mode to a second linear adaptive equalizer;

determining a cross-talk component by convolving the second set of samples, convolving comprising multiplying each sample in the second set of samples by a coefficient;

determining an output by subtracting the cross-talk component of a linear adaptive cross-talk determination logic from a first set of samples on the first propagation mode;



determining a slice residual between the output and an ideal point; and  
 adjusting the coefficients as a function of the slice residual by applying the  
 equation following:

$$CXY_i = CXY_i + \text{AlphaFEXT} * (< CEX_i, CEX_i > / \text{REF\_MAGN}^2) * < TY_{(n-i)}, TX_{\text{residual}} > \quad \text{where,}$$

$CEX_i$  is the  $i$ th time domain equalizer coefficient for the first propagation  
 mode X;

$TY_{(n-i)}$  is the  $(n-i)$  set of samples from the second propagation mode Y;

$TX_{\text{residual}}$  is  $TX_{\text{Corr}} - TX_{\text{IdealPoint}}$

where  $TX_{\text{Corr}}$  is the cross-talk corrected output from ~~the cross-talk adjustment~~  
~~circuit~~ a summer and  $TX_{\text{IdealPoint}}$  is an ideal constellation point for the first  
 propagation mode X;

AlphaFEXT is a constant between 0 and 1; and

$< >$  is a complex scalar product defined as  $< a+jb, c+jd > = (a-jb) * (c+jd) = (ac+bd) + j(ad-bc)$ .

1/2 20. (Currently amended): The method of Claim 19 wherein AlphaFEXT is in the range from  
 0.00001 to 0.001.